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Evaluation of Cassava Leaf Paste on Egg Performance and Egg Quality of Quail Egg Laying Period

(Evaluasi Pemberian Pasta Daun Singkong pada Performa Telur dan Kualitas Telur Puyuh Periode Bertelur)

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ABSTRAK

Puyuh memiliki produksi telur yang tinggi. Di sisi lain, puyuh memiliki kelemahan, yaitu rentan stres. Stres ini dapat disebabkan oleh kondisi cuaca yang tidak menentu. Penelitian ini mengkaji dan mengevaluasi peran dan fungsi pasta daun singkong dalam aspek performa telur dan kualitas telur puyuh periode bertelur yang dipelihara dengan kondisi alamiah atau pada kondisi normal di wilayah tropis, seperti di Indonesia. Penelitian ini dirancang menggunakan rancangan acak lengkap, dengan perlakuan pemberian pasta daun singkong pada burung puyuh pada masa produksi yang mengandung 4 taraf/dosis yaitu P0 (0 mg), P1 (5,29 mg), P2 (10,58 mg), dan P3 (15,87mg). Pengamatan performa telur dideteksi dengan menghitung panjang telur, lebar telur, dan indeks bentuk telur. Pengamatan aspek kualitas telur dideteksi dengan menghitung kualitas cangkang, putih telur, dan kuning telur. Hasil penelitian menunjukkan indeks bentuk telur puyuh pada berbagai level pemberian pasta daun singkong menunjukkan hasil yang tidak berbeda nyata. Indeks bentuk telur yang diperoleh pada P2 dan P3 cenderung lebih lonjong/semi lancip, sedangkan pada P0 dan P1 cenderung bulat. Nilai bobot cangkang telur, bobot putih telur, dan bobot kuning telur yang mendapat pasta daun singkong lebih tinggi dibandingkan perlakuan kontrol. Tingginya bobot cangkang telur, bobot putih telur, dan bobot kuning telur disebabkan adanya perbedaan kandungan nutrisi, unsur mineral, dan flavonoid antar perlakuan. Pemberian pasta daun singkong dapat meningkatkan indeks bentuk telur pada masa puyuh bertelur. Pemberian pasta daun singkong juga dapat meningkatkan bobot cangkang, bobot putih telur, dan bobot kuning telur pada masa bertelur puyuh.

Kata kunci: antioksidan, pasta daun singkong, kualitas telur, indeks bentuk telur

ABSTRACT

Quail has a high egg production. On the other hand, quail has a weakness, which is prone to stress. This stress is caused by erratic weather conditions. This study examines and evaluates the role and function of cassava leaf paste on aspects of egg performance and egg quality of quail eggs in the laying period that are reared under natural conditions or normal conditions in tropical areas, such as in Indonesia. This study was designed using a completely ran-domized design, with the treatment of giving cassa-va leaf paste to quail in the production period con-sisting of 4 levels/dose, namely P0 (0 mg), P1 (5,29 mg), P2 (10,58 mg), and P3 (15,87 mg). Observation of egg performance was detected by calculating egg length, egg width, and egg shape index. Observation of egg quality aspects was detected by calculating the quality of the shell, egg white, and egg yolk. The results showed that the shape index of quail eggs at various levels of cassava leaf paste administration showed results that were not significantly different. The egg shape index obtained at P2 and P3 tends to be more oval/semi-tapered, while at P0 and P1 it tends to be round. The value of the eggshell weight, egg white weight, and egg yolk weight that received cassava leaf paste were higher than the control treatment. The high eggshell weight, egg white weight, and egg yolk weight were suspected to be differences in nutritional content, mineral elements, and flavonoids between treatments. Giving cassava leaf paste can increase the index of egg shape in the quail laying period. The application of cassava leaf paste can also increase the weight of the shell, the weight of the egg white, and the weight of the yolk in the egg-laying period of quail.

Keywords: antioxidants, cassava leaf paste, egg quality, egg shape index

INTRODUCTION

Data from the Directorate General of Livestock and Animal Health (2019) for 2018-2019 shows that the number of quail egg production in Indonesia increased, from 28.957.000 eggs to 29.090.000 eggs. Percentage increase in quail egg production of 0,45%. Quail has a high egg production. The weakness of Quail was is prone to stress (Mehaisen *et al.,* 2019). This stress can be caused by erratic weather conditions (Al-Sagan *et al.,* 2020). Data from the Meteorology, Climatology and Geophysics Agency (2020) showed that weather conditions represented by environmental temperatures in Indonesia range from 18 to 35 °C.

Heat stress occurs when the amount of heat generated by the animal (quail) exceeds the capacity of the animal (quail) to dissipate heat into the surrounding environment or is higher than the thermoneutral zone of the animal (quail) (Kalvandi *et al.,* 2019; Zhang *et al.,* 2020). The thermoneutral zone of poultry (quail) ranges from 18 to 21 °C (Wasti *et al.,* 2020). High environmental temperatures exceeding the range of the thermoneutral zone trigger an increase in oxidative stress in poultry, which will stimulate free radical attack on cell membranes (Mushawwir *et al.,* 2019). These radical compounds cause metabolic disorders and decreased cell function which has a negative impact on egg productivity and quality (Gonzalez-Rivas et al., 2020; Mehaisen et al. 2019). The effects of heat stress can be prevented by administering cassava paste as a defense system against metabolic disorders.

This *heat* stress can be overcome by providing antioxidants that function as a defense system against free radicals in quail (Tugiyanti *et al.,* 2019). Jumadin *et al.* (2022) stated that cassava leaf products in the form of paste can function as antioxidants. Quil heat stress effect could be prevent by the administration of Cassava paste such as blood chemistry, stress indicators, and body resistance.

Cassava leaf paste is a cassava leaf extract like tooth paste. Cassava leaf paste contains high protein, sufficient carbohydrates and fat, and low crude fiber (Jumadin *et al.,* 2022). Cassava leaf paste contains β-carotene, chlorophyll, and antioxidants. Cassava leaf paste also contains flavonoids, tannins, saponins, sitosterol, and stigmasterol (Jumadin *et al.,* 2022). In addition, cassava leaf paste contains macro minerals such as P and Ca, as well as micro minerals such as Fe, Cu, Mn, Zn and low concentration of cyanide acid (Jumadin *et al.,* 2022).

The use of cassava leaf products in the form of paste on quail exposed to heat on production performance and erythrocyte profile has been carried out previously (Jumadin *et al.,* 2017, 2018). However, its role has not been widely studied on the physiological performance of quail reared under natural conditions as is often done. The aim of this study was to evaluate the role and function of cassava leaf paste in egg performance and egg quality aspects of the quail egg-laying period reared under natural conditions or normal conditions in tropical areas, such as in Indonesia.

MATERIALS AND METHODS

Production of Cassava Leaf Paste (Manihot esculenta Crantz)

The cassava leaves used are intact and undamaged. Part of the leaves is the sixth leaf tip. The leaves are first washed with clean water, then dried at room temperature. Then cut into small pieces to facilitate the crushing process which is done in a blender.

Extraction of cassava leaf paste was carried out according to the working procedure of Jumadin et al. (2017). A total of ± 50 grams of cassava leaf pieces are crushed in a blender using 125 mL of 70% ethanol for 3 minutes, intermittently every 1 minute. The solution of cassava leaves in ethanol is then filtered by a fine cloth, then the filtrate obtained is filtered again with a Buchner funnel using filter paper. The residue is washed with 75 mL 70% ethanol, then filtered again with a Buechner funnel. The filtrate is taken as a cassava leaf extract. Furthermore, the extract of the cassava leaves is evaporated for one hour at a temperature of 70 °C, resulting in cassava leaf paste.

Experimental Animals and Cages

The procedure used in this study is by the rules of the Animal Ethics Commission, Faculty of Veterinary Medicine, Bogor Agricultural University (No. 007/KEH/SKE/V/2021). The material using in this research, 160 pcs of layer female quail in ages 42 days. The cage used was a 4-story group cage with 16 plots, measuring 100 cm long x 30 cm wide x 20 cm high. Each plot was filled with 10 quails and their placement was done randomly. Each plot is equipped with excreta storage, lighting, feed, and drinking places. The plot is in an open cage.

Quail fed commercial feed in four group cages namely P0, P1, P2, and P3. Each replication, each treatment consisted of 10 quail laying periods. Commercial quail feed is given once a day, namely in the morning with the amount of 30 g/head/day. Drinking water is ad libitum. The administration of test materil was by oral of cassava leaf paste to quail

in this treatment was carried out through drinking water in 100 mL of water for each treatment. This study was conducted to test the administration of cassava leaf paste for 30 days (quail 42 - 72 days old). The parameter was evaluated egg performances and egg quality aspect.

Egg Performance Observation

The egg permofmance analized are egg length, egg width, and egg shape index. Egg performance such as egg length, egg width, and egg shape index was measured at the end of treatment (72 days old). The length and width of the eggs were measured using a digital caliper. The egg shape index was obtained as the ratio of egg width and length multiplied by 100 (Şengül and Calişlar 2020).

Egg Quality Observation

Egg guality could coclude from the quality of shell, egg white, and egg yolk. Meanwhile based on weight of the shell we can value of the shell quality.

Analysis of egg shell quality in the form of shell weight was measured using an analytical balance. Analysis of egg white quality in the form of egg white weight was calculated using an analytical balance. Analysis of egg yolk quality in the form of egg yolk weight was measured using an analytical balance. The yolk index was obtained as the ratio of yolk height and yolk diameter multiplied by 100 (Şengül and Calişlar 2020).

Data analysis

This study was designed using a completely randomized design, with the treatment of giving cassava leaf paste to quail in the production period consisting of 4 levels/dose, namely P0 (0 mg), P1 (5,29 mg), P2 (10,58 mg), and P3 (15,87 mg). The study was repeated 4 times. Each treatment, each replication consisted of 10 quails.

Data on egg performance and egg quality were analyzed for variance with Duncan's further test to see the effect of differences in treatments P0, P1, P2, and P3 and continued with orthogonal polynomial analysis for treatments P0, P1, P2, and P3. Differences are considered significant at the level of P<0,05, if statistically detected (linear, quadratic, or cubic), then proceed with regression analysis according to the best model.

RESULTS

Quail Egg Performance

The Values of perform quill eggs representing by egg length, egg width, and egg shape index of quail eggs is a describing overall quail eggs of the overall appearance of quail eggs. The performance value of quail eggs is presented in Table 1.

The value of quail egg length showed results that were not significantly different at various levels of cassava leaf paste administration. This result is higher than that of Atuahene *et al.* (2020) which states that the length of quail eggs ranges from 32,00 to 32,67 (P>0,05).The value of egg length that received cassava leaf paste tended to increase compared to the control, except in P1. The index number of quail egg shapes at various levels of cassava leaf paste administration showed results that were not significantly different. The results obtained at P0, P1, and P2 were higher and at P3 were lower than the results of Fathi *et al.* (2020) which got a quail egg shape index of 76,60 to 77,50%. The egg shape index obtained at P2 and P3 tends to be more oval/semi-tapered, while at P0 and P1 it tends to be round.

Table 1. Egg performance values in quail treated 30 days[1]

Parameter	Treatment[2]			
	P0	P1	P2	P3
Egg length (mm)	33,47 ± 1,06	33,45 ± 0,98	33,65 ± 0,51	33,90 ± 0,67
Egg width (mm)	26,25 ± 0,33	26,27 ± 0,35	26,20 ± 0,49	26,23 ± 0,37
Egg shape index (%)	78,46 ± 2,08	78,60 ± 2,53	77,86 ± 1,21	77,39 ± 2,23

Means in the same row with different superscripts differ significantly (P<0,05)

[1] Average value of each treatment (n=4)

[2] P0 = cassava leaf paste 0 mg/g; P1 = cassava leaf paste 5,29 mg/g; P2 = cassava leaf paste 10,58 mg/g; P3 = cassava leaf paste 15,87 mg/g

Quail Egg Quality

Quail egg quality is presented in Table 2. The results of the analysis of eggshell weight variance showed that there was no effect on various levels of cassava leaf paste administration. This result is lower than the study of Atuahene *et al.* (2020) which states that the eggshell weight value ranges from 1,25 to 1,28 g.

The white weight of quail eggs in this study ranged from 5,28 to 6,52 g/egg and was statistically significantly different. This value is higher than the study of Garcia *et al.* (2021) which stated that the weight of quail egg whites ranged from 7,01 to 7,44 g. The equation model for egg white weight (figure 1) is $y = -0{,}0062x^2 + 0{,}179x + 5{,}2384$; $R^2 = 0{,}5083$ ($P<0{,}05$). Based on the equation model, the optimal level of cassava leaf paste for egg white weight in quail was 14,43 mg/head/day. The average weight of quail egg whites can be briefly seen in Figure 1. These results illustrate that when quail are given cassava leaf paste, the average weight of quail egg whites can produce 5,88 to 6,52 g/egg.

The different levels of cassava leaf paste in this study also did not have a significant effect on the egg yolk weight value. The results obtained at P0, P1, and P3 are in the range of values and at P3 are higher than the results of Atuahene *et al.* (2020) who received a quail egg yolk weight of 3,48 to 3,81 g.

The different levels of cassava leaf paste in this study also did not have a significant effect on the yolk index value and were higher than the results of the study by Abou-Elkhair *et al.* (2020) who get an egg yolk index of 32,00 to 45,00%.

DISCUSSION

The different levels of cassava leaf paste in this study also did not have a significant effect on the width of quail eggs. The number of egg widths that received cassava leaf paste at P1 was higher than the other treatments. The results obtained are higher than those of Atuahene *et al.* (2020) which got the width of quail eggs of 25,33 to 26,00 mm.

The egg shape index is related to egg weight, while egg weight is influenced by protein and feed consumption (Nugraha *et al.,* 2018). The level of cassava leaf paste did not affect feed consumption so it did not affect egg weight. This is what makes the egg shape index no different so that it can be said that the increased egg weight due to feed consumption will have a direct effect on the egg shape index.

The egg shape index obtained at P2 and P3 tends to be more oval/semi-tapered, while at P0 and P1 it tends to be round. This is supported by the opinion of Nugraha *et al.* (2018) which divides the shape index

Table 2. Value of egg quality in quail treated 30 days[1]

Parameter	Treatment[2]				Duncan[3]		Orthogonal Polynomials[6]			Regression		
	P0	P1	P2	P3	PSE[4]	(Pr>F)[5]	Linear	Quadratic	Cubic	Model[7]	PSE[4]	R^2(n=4)
Shell weight (g/ butir)	1,15 ± 0,02	1,18 ± 0,05	1,17 ± 0,02	1,17 ± 0,05	0,04	0,89	-	-	-	-	-	-
Egg white weight (g/ butir)	5,28 ± 0,46^{b}	5,88 ± 0,78^{ab}	6,57 ± 0,15^{a}	6,47 ± 0,65^{a}	0,56	0,02	0,00	0,00	0,02	Qd	0,56	0,5083
Egg yolk weight (g/ butir)	3,52 ± 0,09	3,59 ± 0,28	4,12 ± 0,61	3,71 ± 0,31	0,37	0,16	-	-	-	-	-	-
Egg yolk index (%)	49,42 ± 4,01	50,09 ± 5,10	49,91 ± 2,20	47,05 ± 2,55	3,65	0,63	-	-	-	-	-	-

Means in the same row with different superscripts differ significantly ($P<0{,}05$)

[1] Average value of each treatment (n=4)

[2] P0 = cassava leaf paste 0 mg/g; P1 = cassava leaf paste 5,29 mg/g; P2 = cassava leaf paste 10,58 mg/g; P3 = cassava leaf paste 15,87 mg/g

[3] different letters on the same line, indicating the effect of treatment ($P<0{,}05$; Duncan), the tested treatments P0, P1, P2, and P3

[4] PSE = Combined standard error

[5] Probability associated with the F statistic test

[6] If it is significantly different ($P<0{,}05$), the most suitable equation model is selected, the treatments tested are P0, P1, P2, and P3 to get the best equation model

[7] Qd = Quadratic; Cu = cubic

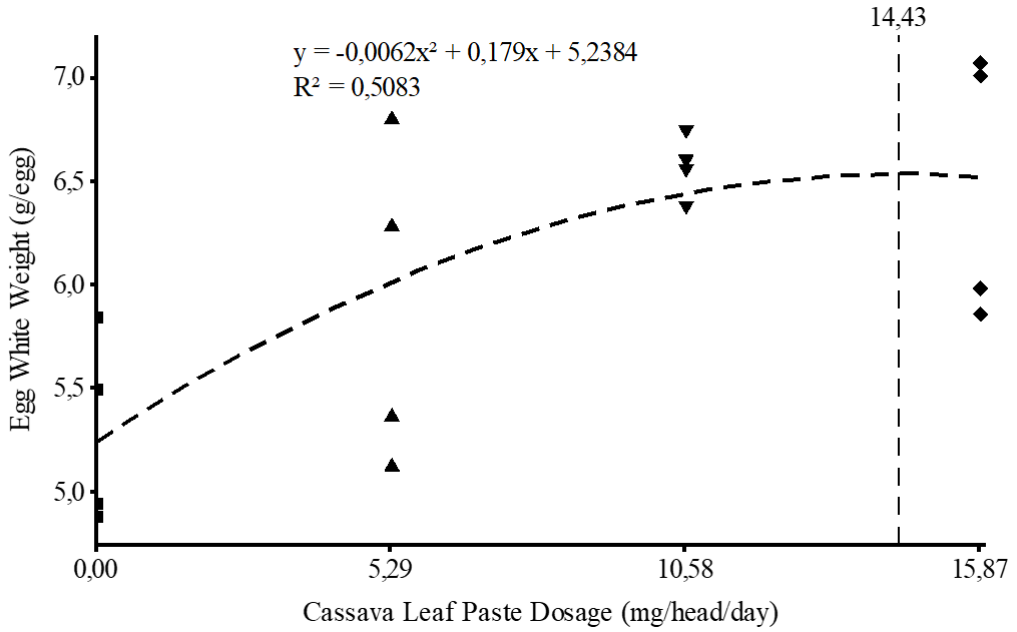

Figure 1. Relationship between egg white weight and dose of cassava leaf paste on quail. ▮ = P0; ▲ = P1; ▼ = P2; ◆ = P3; P0= cassava leaf paste 0 mg/g; P1 = cassava leaf paste 5,29 mg/g; P2 = cassava leaf paste 10,58 mg/g; P3 = cassava leaf paste 15,87 mg/g.

of quail eggs into three classifications, namely acute (70,59 to 75,00%), oval/semi-taper (>75,00 to 78,12%), and round (>78,12 to 82,76%).

The shell weight of quail eggs that received cassava leaf paste was higher than the control treatment. It is suspected that there are differences in nutritional content and mineral elements between treatments, according to the opinion of Abou-Elkhair *et al.* (2020) which states that nutritional content and mineral elements are factors that support the value of quail eggshell weight. Another factor that affects eggshell weight is suspected to be differences in flavonoids in cassava leaf paste. This is supported by the opinion of Abdel-Wareth and Lohakare (2021) and Cui *et al.* (2020) which stated that the increase in egg weight including eggshells was due to the presence of flavonoids which can increase the storage of glucose, phosphorus, calcium, zinc, and iron into the oocyte.

The white weight of quail eggs that received cassava leaf paste tended to increase compared to the control. The cause of the high value of egg white weight is suspected to be differences in nutritional content, mineral elements, and flavonoids in cassava leaf paste, according to the opinion of Abdel-Wareth and Lohakare (2021) and Cui *et al.* (2020) which stated that the increase in egg weight including egg white was due to the presence of flavonoids which have the ability to increase the storage of glucose, protein, phosphorus, calcium, zinc, and iron into the oocyte. Cassava leaf paste contains high crude protein and low crude fiber.

The weight number of quail egg yolks that received cassava leaf paste was higher than the control treatment. The high value of egg yolk weight is thought to be due to differences in nutritional content, mineral elements, and flavonoids in cassava leaf paste. This is supported by the opinion of Abdel-Wareth and Lohakare (2021) and Cui *et al.* (2020) which states that the increase in egg weight including egg yolk is due to the presence of flavonoids which can increase the storage of glucose, triglycerides, cholesterol, phosphorus, calcium, zinc, and iron into oocytes.

Quail that received cassava leaf paste produced a higher yolk index value than the control treatment, except for P3. The high value of the egg yolk index is thought to be due to differences in protein content in cassava leaf paste. This is supported by the opinion of Warisman *et al.* (2017) which states that the increase in the egg yolk index is due to the protein content. The egg yolk index at P3 did not increase, it was suspected that the feed consumption was low, resulting in low protein consumption.

The conclusion of this research is giving cassava leaf paste can increase the index of egg shape in the quail laying period. The application of cassava leaf paste can also increase the weight of the shell, the weight of the egg white, and the weight of the egg yolk in the egg-laying period of quail.

"The author declares that there is no conflict of interest with the parties involved in this research".

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